

simple textual errors or omissions. In addition, some of those textual errors were not made by Applicant, but were inadvertently introduced by the Examiner in the Examiner's Amendment in the Notice of Allowance and Fee(s) Due mailed September 15, 2005.

The detailed reasons for reconsideration of the Office Response to Rule 312 Communication mailed January 20, 2006, are discussed below:

1. The Office Response to Rule 312 Communication mailed January 20, 2006, states that:

"The claim amendments are NOT entered. Amended Claim 130 alters the scope by changing from a single process to a plurality of processes. Therefore, claim 130 is not entered."

Item 130, in Amendments to the Claims, pages 12-13, of Amendment J mailed December 9, 2005, is as follows:

"130 (CURRENTLY AMENDED): ~~A method~~ The method as defined in claim 127, further including the steps of

(A)

constructing a first schedule for executions of the periodic ~~process~~ processes within an interval starting from zero and having length equal to maximum offset value plus a bounded number of times of the length of ~~at least~~ a least common multiple of the periodic process periods, conditions for determining feasibility requiring the existence of a point in said first schedule wherein starting from the latter point the schedule repeats in subschedule interval lengths equal to a least common multiple of lengths of the periodic process periods, timing of all executions of all periodic processes within a time interval having length equal to the length of the least common multiple of the periodic process periods being included in each said repeating subschedule interval, and including satisfaction of all predetermined constraints for all executions of all periodic processes within the subschedule interval starting from time zero and ending at said point plus the length of the least common multiple of the periodic process periods in said first schedule, and checking for the first occurrence of said point in said first schedule,

(B)

generating said feasible two-part pre-run-time-schedule by

(1) using a subschedule interval starting from time zero and ending at said point in said first schedule as said initial part of said feasible two-part pre-run-time schedule, and

(2) using a subschedule interval starting from said point and ending at said point plus the length of the least common multiple of the periodic process periods in said first schedule as said repeating part of said feasible two-part pre-run-time schedule.”

The above amendment to claim 130 is necessary because the Examiner’s Amendment, page 4 of the Notice of Allowance and Fee(s) Due, mailed 09/15/2005, inadvertently changed “... executions of the periodic processes ...” to “... executions of the periodic process ...”; and also inadvertently changed “... a least ...” to “... at least ...”. The Examiner had also previously informed Applicant in the Telephonic Interview on 30 August 2005 that the Examiner will amend claim 130 “A method as defined in claim 127, ...” to “The method as defined in claim 127, ...”, but this was inadvertently omitted in the Examiner’s Amendment to claim 130, page 4 of the Notice of Allowance and Fee(s) Due, mailed 09/15/2005.

Amended claim 130 in Amcndmnet J mailed December 9, 2005 merely restores claim 130 to the version before the above mentioned textual errors were inadvertently introduced into claim 130 by the Examiner’s Amendment, page 4 of the Notice of Allowance and Fee(s) Due, mailed 09/15/2005 (except for the change from “A method” to “The method”, which was to have been done by the Examiner’ Amendment).

2. The Office Response to Rule 312 Communication mailed January 20, 2006, states that:

“ONLY #7 (page 3 Of 8) from the “Amendment to the Specification” of 12/15/05 is entered. All other amendments to the Specification contain new matter.”

Applicant respectfully disagrees with the Office Response statement that “All other amendments to the Specification contain new matter,” and requests reconsideration of the Office Response because the amendments to the specification merely correct obvious

textual errors or omissions, and do not add new matter, which are very evident if one examines related parts of the specification, as explained below.

2.1. Item 3, Amendments to the Specification, page 2, line -2, to page 3, line 2, of Amendment K mailed December 14, 2005, is as follows:

“3. Page 45, please replace the paragraph numbered [0175] with the following rewritten paragraph:

Above, the permitted range of the offset for each new periodic process newp_i , O_{newp_i} is ~~$\{0, \text{newp}_i\}$~~ **$[0, \text{prd}_{\text{newp}_i} - 1]$** .”

The fact that the permitted range of the offset for each new periodic process newp_i should be $[0, \text{prd}_{\text{newp}_i} - 1]$ and not $[0, \text{newp}_i]$ when it is assumed that the earliest time that the asynchronous process a_i can make a request for execution is time 0, is consistently supported throughout the specification in numerous places, including paragraphs [0213], [0214], and [0217] of the specification listed below (Applicant has added bold face to the relevant text in those paragraphs which states that the permitted range of the offset for each new periodic process newp_i should be $[0, \text{prd}_{\text{newp}_i} - 1]$ or its equivalent $0 \leq \text{O}_{\text{newp}_i} \leq \text{prd}_{\text{newp}_i} - 1$):

2.1 (a) Paragraph [0213] of the specification, page 60, states that, assuming that asynchronous process a_A may make its first request at time 0, the permitted range of offset of a new periodic process newp_A is “ $0 \leq \text{O}_{\text{newp}_A} \leq \text{prd}_{\text{newp}_A} - 1$ ”, which is equivalent to $[0, \text{prd}_{\text{newp}_A} - 1]$:

“[0213] Assuming that asynchronous process a_A may make its first request at time 0, the procedure for converting a set of asynchronous processes into a set of periodic processes given earlier, could convert a_A into the following new periodic process:

newp_A : $\text{r}_{\text{newp}_A} = 0$; $\text{c}_{\text{newp}_A} = 2$; $\text{d}_{\text{newp}_A} = 2$; $\text{prd}_{\text{newp}_A} = 6$; and **$0 \leq \text{O}_{\text{newp}_A} \leq \text{prd}_{\text{newp}_A} - 1$** = 5.

The lowerbound of the offset of newp_A is 0, and the upperbound of the offset of

newpA is 5 (see Figure 10 and Figure 13)”

2.1 (b) Paragraph [0214] of the specification, page 61, states that the permitted range of offset of newpA is “[0,pr_d_{newpA} -1]”, or “ $0 \leq o_{\text{newpA}} \leq \text{pr}_{\text{dnewpA}} - 1$ ”:

“[0214] The procedure for constructing a feasible pre-run-time schedule for a given set of periodic processes with offsets given above will try each offset value of o_{newpA} within the permitted range of $[0, \text{pr}_{\text{dnewpA}} - 1] = [0, 5]$, when trying to find a feasible schedule for newpA, p_B, and p_C. When the last value in that permitted range, $o_{\text{newpA}} = 5$ is used, the method in the 1990 article by Xu and Parnas would find the feasible schedule illustrated in Figure 14. A feasible schedule is found for newpA, p_B and p_C, when $o_{\text{newpA}} = 5$ and $o_{\text{pD}} = 2$. It is assumed that the application requires that $o_{\text{pC}} = 7$, $o_{\text{pB}} = 0$ and since asynchronous process a_A may make its first request at time 0, the permitted range of offset is $0 \leq o_{\text{newpA}} \leq \text{pr}_{\text{dnewpA}} - 1 = 5$. The feasible schedule consists of a non-repeating initial schedule $S_0(1)$ for the interval [0,1], and a repeating schedule $S_{\text{LCM}}(12)$ that is of length equal to the Least Common Multiple of the periods of newpA, p_B, p_C, and p_D, which is $\text{LCM}(6, 12, 12, 12) = 12$.”

2.1 (c) Paragraph [0217] of the specification, page 61, states that the permitted range of offset of newpA is “[0,pr_d_{newpA} -1]”:

“[0217] The other periods pr_d_{newpA}, pr_d_{pB}, and pr_d_{pC} remain unchanged after the adjustperiod procedure is applied.

Assuming that the application allows the offset of p_D to be in the permitted range of [0, 4], the procedure for constructing a feasible pre-run-time schedule for a given set of periodic processes with offsets given above will try each offset value of o_{newpA} within the permitted range of $[0, \text{pr}_{\text{dnewpA}} - 1] = [0, 5]$, and try each offset value of o_{pD} within the specified permitted range of [0, 4], when trying to find a feasible schedule for newpA, p_B, p_C, and p_D. When the offset values $o_{\text{newpA}} = 5$, and $o_{\text{pD}} = 2$ as shown in Figure 17 are used, the method described in the 1990 Xu and Parnas article would find the feasible schedule illustrated in Figure 18.”

Thus it should be obvious that the correction in item 3, Amendments to the Specification, page 2, line -2, to page 3, line 2, of Amendment K mailed December 14, 2005 is very consistently supported by the specification, and does not introduce new matter.

2.2. Item 3, Amendments to the Specification, page 4 of 9, of Amendment L mailed December 15, 2005, is as follows:

“3. Pages 96-97, please replace the paragraph numbered [0315] with the following rewritten paragraph:

In the case that A-h-k process a_3 remains asynchronous, because the latitude of a_3 , $La_3 = da_3 = 114$, as well as the latitudes of a_0 and a_1 are greater than the latitudes of the periodic processes p_4, p_6, p_7 in meeting their respective deadlines, the worst-case computation times of p_4, p_6, p_7 should be adjusted to leave “room” for a_0, a_1 and a_3 's worst-case computation time as follows:

$$c_{p4}' = e_{p4} - e_{a0} \quad \underline{c_{p4} + c_{a0}} + c_{a1} + c_{a3} = 26 + 2 + 2 + 10 = 40$$

$$c_{p6}' = e_{p6} - e_{a0} \quad \underline{c_{p6} + c_{a0}} + c_{a1} + c_{a3} = 26 + 2 + 2 + 10 = 40$$

$$c_{p7}' = e_{p7} - e_{a0} \quad \underline{c_{p7} + c_{a0}} + c_{a1} + c_{a3} = 16 + 2 + 2 + 10 = 30$$

The pre-run-time scheduler will first construct the feasible pre-run-time schedule illustrated in Figure 8 for the set of P-g processes p_4, p_5, p_6, p_7 . Then the simulation procedure for determining the worst-case response time of an A-h-k-a process can be used to determine a_0, a_1, a_2, a_3, a_9 's worst-case response time.

A-h-k-a process a_3 's worst-case response time happens when a_3 arrives at time 7, while a_2 which excludes a_3 arrived one time unit before a_3 at time 6. If a_0, a_1 which have less latitude than a_3 in meeting their respective deadlines, arrive at the same ~~time 6~~ time as a_3 , that is, at time 7, a_0 will preempt a_2 and execute from time 7 to time 9, a_1 will execute from time 9 to time 11, a_2 will continue its execution from time 11 to time 20, p_8 will first execute from time 20 to time 30; at time 30 p_8 will be preempted by p_5 which executes from time 30 to time 46; at time 46 p_8 will continue its execution from time 46 to time 52. At time 52,

because $La_3 = da_3 = 114 < Lp_4 = dp_4 - rp_4 = 200 - 0 = 200$, a_3 will execute from time 52 to time 62. A-h-k-a process a_3 's worst-case response time $REa_3 = RE(a_3, ts) = RE(a_3, 7) = e'(a_3) - Ra_3 = 62 - 7 = 45 \leq da_3 = 114$. Similarly, one can verify that the worst-case response times of all the other asynchronous processes are all less than or equal to their respective deadlines, as shown in

Figure 8 Figure 9."

Applicant submits that the corrections in the above amendment to the specification, are obvious typos, are consistently supported by related parts of the specification, and obviously do not introduce new matter, for the following reasons:

2.2 (a) In the first correction in the paragraph [0315] above, it should be obvious that " $c_{p4} c_{a0} + c_{a1} + c_{a3}$ " should be corrected as " $c_{p4} + c_{a0} + c_{a1} + c_{a3}$ ", that is, *the sum* of the four variables c_{p4} , c_{a0} , c_{a1} and c_{a3} , because it is immediately followed by " $= 26 + 2 + 2 + 10$ ", which is *the sum* of the four values. The same applies to the next two corrections, that is, " $c_{p6} c_{a0} + c_{a1} + c_{a3}$ " should be corrected as " $c_{p6} + c_{a0} + c_{a1} + c_{a3}$ "; and " $c_{p7} c_{a0} + c_{a1} + c_{a3}$ " should be corrected as " $c_{p7} + c_{a0} + c_{a1} + c_{a3}$ ".

2.2 (b) In the next correction in the paragraph [0315] above, it should be obvious that the arrival time of a_0 and a_1 should not be "time 6", but should be corrected as "same time as a_3 , that is, at time 7", because the text immediately following the text to be corrected states that " a_0 will ... *execute from time 7* ...". If either a_0 or a_1 were to arrive at time 6 instead of time 7, then either a_0 or a_1 would have started execution at time 6, because both a_0 and a_1 have deadlines of which are earlier than a_2 's deadline, but Figure 9 clearly shows that a_2 starts at time 6. In Figure 9, each process execution is represented by blocks which have a height that is different from other processes, - note that the block starting at time 6 has a height that is identical to the block labeled as a_2 , so Figure 9 shows a_2 starting execution at time 6.

2.2 (c) In the last correction in the paragraph [0315] above, it should be obvious that "Figure 8" in the last sentence of the paragraph should be corrected as "Figure 9",

because the last sentence of the paragraph mentions “asynchronous processes”, but *Figure 8 does not show any asynchronous processes, only Figure 9 shows the asynchronous processes a_0, a_1, a_2, a_3, a_8 mentioned in paragraph [0315].*

2.3. Item 1, Amendments to the Specification, page 3 of 9, of Amendment L mailed December 15, 2005, is as follows:

“1. Page 33, please replace the paragraph numbered [0132] with the following rewritten paragraph:

- period,
- worst-case execution time,
- release time,
- deadline,
- permitted range of the offset,
- the set of data that each segment reads and writes,
- any exclusion relationships with other process segments,
- any precedence relationships with other periodic process segments.”

The fact that it is assumed that it assumed that the permitted range of offset is known for each P-h-k process, is consistently supported throughout the specification in numerous places. Because there are too many examples of such places, only one example is listed here, that is, paragraph [0149], as follows (Applicant has added bold face to the relevant text which assumes that the permitted range of the offset for each P-h-k process is known):

“[0149] Assume 4 asynchronous processes with hard deadlines and known characteristics (A-h-k processes), and 4 periodic processes with hard deadlines and known characteristics (P-h-k processes) as follows.

a_0 : $c_{a0} = 2$, $d_{a0} = 2$, $\min_{a0} = 1,000$;

a_1 : $c_{a1} = 2$, $d_{a1} = 7$, $\min_{a1} = 1,000$;

$a_2: c_{a2} = 10, d_{a2} = 239, \min_{a2} = 1,000;$

$a_9: c_{a9} = 10, d_{a9} = 259, \min_{a9} = 1,000;$

$p_4: r_{p4} = 0, c_{p4} = 26, d_{p4} = 200, \text{prd}_{p4} = 200, o_{p4} = 0;$

$p_5: r_{p5} = 30, c_{p5} = 16, d_{p5} = 50, \text{prd}_{p5} = 200, o_{p5} = 0;$

$p_6: r_{p6} = 0, c_{p6} = 26, d_{p6} = 200, \text{prd}_{p6} = 200, o_{p6} = 0;$

$p_7: r_{p7} = 0, c_{p7} = 16, d_{p7} = 200, \text{prd}_{p7} = 200, o_{p7} = 0."$

Thus it should be obvious that the correction in item 1, Amendments to the Specification, page 3 of 9, of Amendment L mailed December 15, 2005 is very consistently supported by the specification, and does not introduce new matter.

2.4. Item 2, Amendments to the Specification, page 3 of 9, of Amendment L mailed December 15, 2005, is as follows:

"2. Page 33, please replace the paragraph numbered [0136] with the following rewritten paragraph:

- period,
- worst-case execution time,
- release time,
- deadline,
- permitted range of the offset,
- the set of data that each segment reads and writes,
- any exclusion relationships with other process segments,
- any precedence relationships with other periodic process segments."

The fact that it is assumed that the permitted range of offset is known for each P-s-k process, is supported in the specification in paragraph [0266], as follows (Applicant has added bold face to the relevant text which assumes that the permitted range of the offset for each P-s-k process is known):

“[0266] Assume that in addition to the hard deadline processes described in Examples 1-7 above, the following periodic process has a soft deadline and known characteristics (P-s-k process).

p₈: R_{p8} = 20, c_{p8} = 16, d_{p8} = 55, prd_{p8} = 200, o_{p8} = 0;

Assume further that p₈'s criticality is 3, its deadline upperlimit is 100.”

Thus it should be obvious that the correction in item 2, Amendments to the Specification, page 3 of 9, of Amendment L mailed December 15, 2005 is very consistently supported by the specification, and does not introduce new matter.

3. The Office Response to Rule 312 Communication mailed January 20, 2006, states that:

“The drawings are NOT entered. Although the drawings may be supported in the Specification, the Drawings also introduce new matter.”

Applicant respectfully disagrees with the Office Response statement that “the Drawings also introduce new matter,” and requests reconsideration of the Office Response for the reasons below.

3.1. The amendments to the drawings Figs. 25A, 25B, 26, 27A and 27B in Enclosure A of Amendment J mailed December 9, 2005 were made to increase the heights of the numbers, letters and reference characters of Figs. 25A, 25B, 26, 27A and 27B to be at least .32 cm (1/8 inch) in height in accordance with 37 CFR 1.84(p)(3) in response to the Draftsperson's Patent Drawing Review comments in the Notice of Allowance and Fee(s) Due, mailed 09/15/2005.

The minor textual corrections are all fully supported by corresponding text in the specification and do not add new matter as shown in detail in the Remarks concerning the amendments to the drawings, pages 37-38 of Amendment J mailed December 9, 2005.

3.2. The replacement drawing Fig. 9 in Enclosure A of Amendment L faxed 12/15/2005 only corrects minor omissions in the previous version of Fig. 9. As shown in the Annotated Sheet of Fig. 9 in Enclosure A of Amendment L faxed 12/15/2005, only four minor changes were made to Fig. 9 as follows:

3.2 (a) The omitted reference to A-h-k-a process a_3 's arrival time " Ra_3 " was added to the position corresponding to time 7 in Fig. 9. This is supported by the fact that paragraph [0315] of the specification, line -11, state that, "... a_3 arrives at time 7 ..." This only corrects a minor omission and does not add new matter.

3.2 (b) The reference to A-h-k-a process a_1 's arrival time " Ra_1 " was shifted left to the position corresponding to time 7 in Fig. 9. This supported by the same reasons as provided in 2.2 (b) above. This only corrects a minor mistake and does not add new matter.

3.2 (c) A line from the reference " a_0 " to the block representing a_0 was added. This only adds a minor clarification to the diagram and does not add new matter.

3.2 (d) A line from the reference " a_0 " to the block representing a_0 was added. This only adds a minor clarification to the diagram and does not add new matter.

Conclusion

Applicant respectfully requests reconsideration of the Office Response to Rule 312 Communication mailed January 20, 2006, because most of the amendments to drawings, claims, and specification in Applicant's Amendment J, K, and L, merely correct obvious textual errors or omissions and do not add new matter, and are (A) needed for proper disclosure or protection of the invention, and (B) require no substantial amount of additional work on the part of the Office, and comply with 37 CFR 1.312. In addition, some of those textual errors were not made by Applicant, but were inadvertently

introduced by the Examiner in the Notice of Allowance and Fee(s) Due mailed September 15, 2005.

Hence Applicant respectfully requests approval of the entry of the amendments to drawings, claims, and specification in Applicant's previously filed Amendment J, mailed December 9, 2005; Amendment K, mailed December 14; and Amendment L, faxed December 15, 2005, respectively under 37 CFR 1.312.

Very respectfully,

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